CORNELL AERONAUTICAL LABORATORY, INC.

Report No. BE-1007-A-5

THERMODYNAMIC PROPERTIES OF NITROGEN FROM 2000°K TO 8000°K

BY

C. E. Treanor and J. G. Logan, Jr.

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Approved: F.K. Moore
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ABSTRACT

~~This report presents~~ tables of thermodynamic properties of nitrogen at high temperatures, including effects of dissociation and ionisation. The partition functions, first and second temperature derivatives of partition functions, equilibrium constants and temperature derivatives of equilibrium constants are tabulated at intervals of 500°K between 2000°K and 8000°K. The mole fraction composition, temperature and density derivatives of mole fraction composition, pressure, entropy, enthalpy, specific heats and speed of sound are tabulated at the temperatures given above and at densities of 1/1000, 1/100, 1/10 ~~10^{-3}, 10^{-2}, 10^{-1}~~, 1 and 10 times standard atmospheric density. All quantities were calculated directly from the formulas of statistical mechanics, using digital computers and employing the most recent spectroscopic data. Effects of the second virial coefficient are not included.

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LIST OF SYMBOLS

a	Speed of sound
c_p	Specific heat at constant pressure
c_v	Specific heat at constant volume
f_i	Partition function, including translation, dissociation and ionization for species i
H	Enthalpy
K_1, K_2, K_3	Equilibrium constants (see "Contents of Tables", Table IV)
M	Molecular weight of gas
M_i	Molecular weight of i^{th} species
$[N_2]$, $[N]$ etc.	Number of moles of N_2, N, etc. originating from one mole of N_2 at standard conditions
P	Pressure
Q_i	Internal partition functions for species i
S	Entropy
T	Temperature (^oK)
X_i	Mole fraction of species i, i.e., number of moles of species i per mole of gas
Z	Total number of moles of gas originating from one mole of N_2 at standard conditions
γ	Specific heat ratio
ρ	Density

Subscript zero refers to NACA standard conditions (see page 2)

INTRODUCTION

In the course of calculating the thermodynamic properties of air at high temperatures[1], the partition functions for the atomic and molecular constituents of air were calculated from spectroscopic data and were available on punched cards. A relatively easy program could then be prepared for the IBM card programmed calculator to obtain the thermodynamic properties of pure oxygen and pure nitrogen. Tables of these properties are of value in various aerodynamic calculations, and are not available at present in a form that includes the effects of dissociation and ionization. Accordingly, the calculations were performed for oxygen over the temperature range from 2000°K to 5000°K at 100° intervals and for 15 densities between 10^{-3} and about 15 times standard atmospheric density[2]. The present report is the result of a similar calculation for nitrogen covering the temperature range from 2000°K to 8000°K at 500° intervals and for five densities from 10^{-3} to 10 times atmospheric density.

NUMERICAL CALCULATIONS

The thermodynamic properties of nitrogen that are tabulated herein were calculated from spectroscopic data as given in Herzberg[3] and Moore[4], with the exception that the dissociation energy of N_2 was taken as 9.756 e.v. instead of the value given in Herzberg. The formulas and calculation procedures that were used are exactly parallel to those used for oxygen in Ref. 2, and so are not repeated here. All calculations were performed on the IBM card-programmed calculator at Cornell Aeronautical Laboratory. Reference conditions (subscript zero) were taken at the pressure and

temperature of NACA standard reference conditions in order to make the tables most useful for aerodynamic calculations. These conditions are

$$P_o = 1.013\text{x}10^6 \frac{\text{dynes}}{\text{cm}^2} = 14.7 \frac{\text{lbs.}}{\text{in.}^2} \qquad T_o = 288.10^oK = 518.6^oR$$

Thus, with the molecular weitht of N_2 = 28.014 and $\gamma_o = 1.4$,

$$\rho_o = 1.1845\text{x}10^{-3} \frac{\text{gms}}{\text{cm}^3} = 2.2963\text{x}10^{-4} \frac{\text{slug}}{\text{ft}^3}$$

$$a_o = 3.460\text{x}10^4 \frac{\text{cm}}{\text{sec.}} = 1135 \frac{\text{ft.}}{\text{sec.}}$$

It should be pointed out that these reference conditions are different from those used by Woolley[5] in his calculations for undissociated nitrogen. Also the present calculations do not include the real gas effects of the higher virial coefficients, which are included in Woolley's work.

LIST AND DESCRIPTION OF TABLES

The temperature range covered in the tables is 2000°K to 8000°K at intervals of 500°K. The functions which are density dependent were calculated at density values of $\rho/\rho_o = 10^{-3}, 10^{-2}, 10^{-1}$, 1 and 10. Tables I through IX contain functions which are not density dependent. These are:

Table I Internal partition functions Q_i

Table II Temperature derivatives of partition functions, $\frac{dQ_i}{dT}$

Table III Second temperature derivatives of partition functions, $\frac{d^2Q_i}{dT^2}$

Table IV $\frac{\rho}{\rho_o}$ times the equilibrium constants

$$K_1 = \frac{[N]^2}{[N_2]} \qquad K_2 = \frac{[N_2^+][e^-]}{[N_2]} \qquad K_3 = \frac{[N^+][e^-]}{[N]}$$

Table V	Temperature derivatives of the ln of the equilibrium constant from Table IV
Table VI	P/P_o times the partition functions including translation, dissociation and ionization
Table VII	ln of partition functions from Table VI
Table VIII	Temperature derivatives of ln of the partition functions from Table VI
Table IX	Temperature derivatives of the product of T^2 and temperature derivatives from Table VIII

The remaining tables list functions which are density dependent:

Table X	Mole fractions, the fractional number of particles of each species at a given temperature and density
Table XI	Temperature derivatives of mole fractions from Table X(density const.)
Table XII	Density derivatives of mole fractions from Table X (temp. const.)
Table XIII	Entropy in non-dimensional form and in cal/gm$^{\circ}$K; enthalpy in non-dimensional form and in cal/gm; compressibility factor Z, equal to the ratio of the molecular weight at standard conditions to the molecular weight
Table XIV	Pressure P/P_o; density derivatives of P/P_o at constant temperature; gram molecular weight; and derivatives of the molecular weight with respect to temperature and density.
Table XV	Specific heat at constant volume; specific heat at constant pressure; specific heat ratio $\gamma = c_p/c_v$; and speed of sound a/a_o.

REFERENCES

1. Logan, J.G. and Treanor, C.E. Tables of Thermodynamic Properties of Air from 3000°K to 10,000°K at Intervals of 100°K Cornell Aeronautical Laboratory Report No. BE-1007-A-3

2. Treanor, C.E. and Logan, J.G. Thermodynamic Properties of Oxygen from 2000°K to 5000°K Cornell Aeronautical Laboratory Report No. BE-1007-A-4

3. Herzberg, G. The Spectra of Diatomic Molecules D. Van Nostrand Company New York (1950)

4. Moore, C.E. Atomic Energy Levels N.B.S. Circular No. 467 (1949)

5. Woolley, H.W. Thermodynamic Properties of Gaseous Nitrogen NACA TN 3271 (March 1956)

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T°K	Q_{N_2}	Q_N	$Q_{N_2^+}$	Q_{N^+}
2000	$8.57628\text{X}10^{+02}$	$4.00000\text{X}10^{+00}$	$1.84392\text{X}10^{+03}$	$8.44543\text{X}10^{+00}$
2500	$1.18249\text{X}10^{+03}$	$4.00015\text{X}10^{+00}$	$2.58307\text{X}10^{+03}$	$8.55336\text{X}10^{+00}$
3000	$1.56062\text{X}10^{+03}$	$4.00099\text{X}10^{+00}$	$3.48782\text{X}10^{+03}$	$8.62835\text{X}10^{+00}$
3500	$1.99280\text{X}10^{+03}$	$4.00374\text{X}10^{+00}$	$4.59028\text{X}10^{+03}$	$8.68664\text{X}10^{+00}$
4000	$2.47969\text{X}10^{+03}$	$4.01012\text{X}10^{+00}$	$5.92312\text{X}10^{+03}$	$8.73718\text{X}10^{+00}$
4500	$3.02183\text{X}10^{+03}$	$4.02202\text{X}10^{+00}$	$7.51740\text{X}10^{+03}$	$8.78519\text{X}10^{+00}$
5000	$3.61975\text{X}10^{+03}$	$4.04111\text{X}10^{+00}$	$9.40179\text{X}10^{+03}$	$8.83367\text{X}10^{+00}$
5500	$4.27399\text{X}10^{+03}$	$4.06867\text{X}10^{+00}$	$1.16024\text{X}10^{+04}$	$8.88422\text{X}10^{+00}$
6000	$4.98513\text{X}10^{+03}$	$4.10555\text{X}10^{+00}$	$1.41430\text{X}10^{+04}$	$8.93756\text{X}10^{+00}$
6500	$5.75386\text{X}10^{+03}$	$4.15212\text{X}10^{+00}$	$1.70456\text{X}10^{+04}$	$8.99391\text{X}10^{+00}$
7000	$6.58108\text{X}10^{+03}$	$4.20840\text{X}10^{+00}$	$2.03301\text{X}10^{+04}$	$9.05315\text{X}10^{+00}$
7500	$7.46802\text{X}10^{+03}$	$4.27413\text{X}10^{+00}$	$2.40153\text{X}10^{+04}$	$9.11503\text{X}10^{+00}$
8000	$8.41640\text{X}10^{+03}$	$4.34884\text{X}10^{+00}$	$2.81188\text{X}10^{+04}$	$9.17923\text{X}10^{+00}$

Table I

Internal partition functions

T°K	$\frac{dQ_{N_2}}{dT}$	$\frac{dQ_N}{dT}$	$\frac{dQ_{N_2^+}}{dT}$	$\frac{dQ_{N^+}}{dT}$
2000	$5.97216\text{X}10^{-01}$	$6.83546\text{X}10^{-08}$	$1.33239\text{X}10^{+00}$	$2.66394\text{X}10^{-04}$
2500	$7.02669\text{X}10^{-01}$	$6.96904\text{X}10^{-07}$	$1.63362\text{X}10^{+00}$	$1.75680\text{X}10^{-04}$
3000	$8.10084\text{X}10^{-01}$	$3.07505\text{X}10^{-06}$	$1.99621\text{X}10^{+00}$	$1.29435\text{X}10^{-04}$
3500	$9.18882\text{X}10^{-01}$	$8.50111\text{X}10^{-06}$	$2.42458\text{X}10^{+00}$	$1.06599\text{X}10^{-04}$
4000	$1.02884\text{X}10^{+00}$	$1.76660\text{X}10^{-05}$	$2.91714\text{X}10^{+00}$	$9.72546\text{X}10^{-05}$
4500	$1.13988\text{X}10^{+00}$	$3.04816\text{X}10^{-05}$	$3.46955\text{X}10^{+00}$	$9.57709\text{X}10^{-05}$
5000	$1.25198\text{X}10^{+00}$	$4.63053\text{X}10^{-05}$	$4.07670\text{X}10^{+00}$	$9.86669\text{X}10^{-05}$
5500	$1.36517\text{X}10^{+00}$	$6.42430\text{X}10^{-05}$	$4.73370\text{X}10^{+00}$	$1.03753\text{X}10^{-04}$
6000	$1.47961\text{X}10^{+00}$	$8.33773\text{X}10^{-05}$	$5.43623\text{X}10^{+00}$	$1.09682\text{X}10^{-04}$
6500	$1.59560\text{X}10^{+00}$	$1.02895\text{X}10^{-04}$	$6.18062\text{X}10^{+00}$	$1.15653\text{X}10^{-04}$
7000	$1.71367\text{X}10^{+00}$	$1.22142\text{X}10^{-04}$	$6.96375\text{X}10^{+00}$	$1.21228\text{X}10^{-04}$
7500	$1.83463\text{X}10^{+00}$	$1.40628\text{X}10^{-04}$	$7.78302\text{X}10^{+00}$	$1.26189\text{X}10^{-04}$
8000	$1.95966\text{X}10^{+00}$	$1.58013\text{X}10^{-04}$	$8.63626\text{X}10^{+00}$	$1.30460\text{X}10^{-04}$

Table II

Temperature derivatives of partition functions

T °K	$\frac{d^2Q_{N_2}}{dT^2}$	$\frac{d^2Q_N}{dT^2}$	$\frac{d^2Q_{N_2^+}}{dT^2}$	$\frac{d^2Q_{N^+}}{dT^2}$
2000	$2.08136X10^{-04}$	$4.04453X10^{-10}$	$5.48202X10^{-04}$	$2.52854X10^{-07}$
2500	$2.13166X10^{-04}$	$2.53168X10^{-09}$	$6.61011X10^{-04}$	$1.26687X10^{-07}$
3000	$2.16320X10^{-04}$	$7.44109X10^{-09}$	$7.90735X10^{-04}$	$-6.46611X10^{-08}$
3500	$2.18805X10^{-04}$	$1.44976X10^{-08}$	$9.22094X10^{-04}$	$-2.98072X10^{-08}$
4000	$2.21020X10^{-04}$	$2.21235X10^{-08}$	$1.04663X10^{-03}$	$-9.38877X10^{-09}$
4500	$2.23132X10^{-04}$	$2.89141X10^{-08}$	$1.16125X10^{-03}$	$2.31912X10^{-09}$
5000	$2.25260X10^{-04}$	$3.40749X10^{-08}$	$1.26569X10^{-03}$	$8.54941X10^{-09}$
5500	$2.27563X10^{-04}$	$3.73659X10^{-08}$	$1.36086X10^{-03}$	$1.13576X10^{-08}$
6000	$2.30296X10^{-04}$	$3.88986X10^{-08}$	$1.44804X10^{-03}$	$1.20959X10^{-08}$
6500	$2.33838X10^{-04}$	$3.89553X10^{-08}$	$1.52846X10^{-03}$	$1.16483X10^{-08}$
7000	$2.38706X10^{-04}$	$3.78695X10^{-08}$	$1.60320X10^{-03}$	$1.05803X10^{-08}$
7500	$2.45540X10^{-04}$	$3.59615X10^{-08}$	$1.67318X10^{-03}$	$9.24237X10^{-09}$
8000	$2.55075X10^{-04}$	$3.35094X10^{-08}$	$1.73915X10^{-03}$	$7.84317X10^{-09}$

Table III

Second temperature derivatives of partition functions

T °K	$\rho/\rho_0\ K_1$	$\rho/\rho_0\ K_2$	$\rho/\rho_0\ K_3$
2000	$1.20430X10^{-19}$	$2.09937X10^{-38}$	$8.40159X10^{-36}$
2500	$1.00389X10^{-14}$	$2.09706X10^{-30}$	$2.51453X10^{-28}$
3000	$1.89170X10^{-11}$	$4.80632X10^{-25}$	$2.54928X10^{-23}$
3500	$4.09453X10^{-09}$	$3.40518X10^{-21}$	$9.94647X10^{-20}$
4000	$2.29626X10^{-07}$	$2.73842X10^{-18}$	$5.04242X10^{-17}$
4500	$5.24498X10^{-06}$	$5.14838X10^{-16}$	$6.53504X10^{-15}$
5000	$6.40205X10^{-05}$	$3.49041X10^{-14}$	$3.25122X10^{-13}$
5500	$4.96370X10^{-04}$	$1.12440X10^{-12}$	$8.04493X10^{-12}$
6000	$2.74276X10^{-03}$	$2.06889X10^{-11}$	$1.17698X10^{-10}$
6500	$1.16944X10^{-02}$	$2.47017X10^{-10}$	$1.14782X10^{-09}$
7000	$4.07127X10^{-02}$	$2.09667X10^{-09}$	$8.13071X10^{-09}$
7500	$1.20595X10^{-01}$	$1.35292X10^{-08}$	$4.45596X10^{-08}$
8000	$3.13395X10^{-01}$	$6.97980X10^{-08}$	$1.98126X10^{-07}$

Table IV

$\frac{\rho}{\rho_0}$ times the equilibrium constants

$T\,^\circ K$	$\frac{1}{K_1}\frac{\partial K_1}{\partial T}$	$\frac{1}{K_2}\frac{\partial K_2}{\partial T}$	$\frac{1}{K_3}\frac{\partial K_3}{\partial T}$
2000	2.83470×10^{-02}	4.59481×10^{-02}	4.29489×10^{-02}
2500	1.81138×10^{-02}	2.95482×10^{-02}	2.76075×10^{-02}
3000	1.25572×10^{-02}	2.06296×10^{-02}	1.92553×10^{-02}
3500	9.21036×10^{-03}	1.52456×10^{-02}	1.42076×10^{-02}
4000	7.04224×10^{-03}	1.17455×10^{-02}	1.09235×10^{-02}
4500	5.56008×10^{-03}	9.34050×10^{-03}	8.66602×10^{-03}
5000	4.50397×10^{-03}	7.61524×10^{-03}	7.04649×10^{-03}
5500	3.72616×10^{-03}	6.33445×10^{-03}	5.84447×10^{-03}
6000	3.13751×10^{-03}	5.35667×10^{-03}	4.92723×10^{-03}
6500	2.68168×10^{-03}	4.59268×10^{-03}	4.21102×10^{-03}
7000	2.32160×10^{-03}	3.98392×10^{-03}	3.64089×10^{-03}
7500	2.03211×10^{-03}	3.49064×10^{-03}	3.17951×10^{-03}
8000	1.79566×10^{-03}	3.08504×10^{-03}	2.80084×10^{-03}

Table V

Temperature derivatives of *ln* of equilibrium constants

$T\,^\circ K$	$\rho/\rho_0\ f_{N_2}$	$\rho/\rho_0\ f_N$	$\rho/\rho_0\ f_{N_2^+}$	$\rho/\rho_0\ f_{N^+}$	$\rho/\rho_0\ f_{e^-}$
2000	$2.52884\times10^{+34}$	$4.30054\times10^{+19}$	3.15886×10^{-05}	2.14745×10^{-17}	$1.02176\times10^{+25}$
2500	$4.87291\times10^{+34}$	$1.72359\times10^{+22}$	$4.34967\times10^{+03}$	1.84317×10^{-07}	$1.42795\times10^{+25}$
3000	$8.45390\times10^{+34}$	$9.85485\times10^{+23}$	$1.31550\times10^{+09}$	8.12773×10^{-01}	$1.87709\times10^{+25}$
3500	$1.36033\times10^{+35}$	$1.83916\times10^{+25}$	$1.18998\times10^{+13}$	$4.69647\times10^{+04}$	$2.36541\times10^{+25}$
4000	$2.06807\times10^{+35}$	$1.69819\times10^{+26}$	$1.19069\times10^{+16}$	$1.79937\times10^{+08}$	$2.88998\times10^{+25}$
4500	$3.00723\times10^{+35}$	$9.78703\times10^{+26}$	$2.72782\times10^{+18}$	$1.12632\times10^{+11}$	$3.44845\times10^{+25}$
5000	$4.21903\times10^{+35}$	$4.05005\times10^{+27}$	$2.21518\times10^{+20}$	$1.97987\times10^{+13}$	$4.03887\times10^{+25}$
5500	$5.74720\times10^{+35}$	$1.31621\times10^{+28}$	$8.42547\times10^{+21}$	$1.38003\times10^{+15}$	$4.65960\times10^{+25}$
6000	$7.63805\times10^{+35}$	$3.56681\times10^{+28}$	$1.80816\times10^{+23}$	$4.80184\times10^{+16}$	$5.30923\times10^{+25}$
6500	$9.94050\times10^{+35}$	$8.40212\times10^{+28}$	$2.49170\times10^{+24}$	$9.78318\times10^{+17}$	$5.98653\times10^{+25}$
7000	$1.27064\times10^{+36}$	$1.77244\times10^{+29}$	$2.41895\times10^{+25}$	$1.30808\times10^{+19}$	$6.69040\times10^{+25}$
7500	$1.59910\times10^{+36}$	$3.42214\times10^{+29}$	$1.77121\times10^{+26}$	$1.24805\times10^{+20}$	$7.41988\times10^{+25}$
8000	$1.98536\times10^{+36}$	$6.14697\times10^{+29}$	$1.02979\times10^{+27}$	$9.04801\times10^{+20}$	$8.17410\times10^{+25}$

Table VI

$\frac{\rho}{\rho_0}$ times partition functions

T°K	$\ln P/P_0\, f_{N_2}$	$\ln P/P_0\, f_N$	$\ln P/P_0\, f_{N_2^+}$	$\ln P/P_0\, f_{N^+}$	$\ln P/P_0\, f_{e^-}$
2000	$7.92156\times10^{+01}$	$4.52078\times10^{+01}$	$-1.03627\times10^{+01}$	$-3.83796\times10^{+01}$	$5.75861\times10^{+01}$
2500	$7.98715\times10^{+01}$	$5.12012\times10^{+01}$	$8.37785\times10^{+00}$	$-1.55066\times10^{+01}$	$5.79208\times10^{+01}$
3000	$8.04225\times10^{+01}$	$5.52474\times10^{+01}$	$2.09974\times10^{+01}$	-2.07302×10^{-01}	$5.81943\times10^{+01}$
3500	$8.08982\times10^{+01}$	$5.81739\times10^{+01}$	$3.01075\times10^{+01}$	$1.07571\times10^{+01}$	$5.84255\times10^{+01}$
4000	$8.13170\times10^{+01}$	$6.03967\times10^{+01}$	$3.70159\times10^{+01}$	$1.90081\times10^{+01}$	$5.86258\times10^{+01}$
4500	$8.16915\times10^{+01}$	$6.21482\times10^{+01}$	$4.24500\times10^{+01}$	$2.54473\times10^{+01}$	$5.88025\times10^{+01}$
5000	$8.20300\times10^{+01}$	$6.35685\times10^{+01}$	$4.68470\times10^{+01}$	$3.06166\times10^{+01}$	$5.89605\times10^{+01}$
5500	$8.23391\times10^{+01}$	$6.47471\times10^{+01}$	$5.04855\times10^{+01}$	$3.48608\times10^{+01}$	$5.91035\times10^{+01}$
6000	$8.26236\times10^{+01}$	$6.57440\times10^{+01}$	$5.35517\times10^{+01}$	$3.84103\times10^{+01}$	$5.92340\times10^{+01}$
6500	$8.28870\times10^{+01}$	$6.66008\times10^{+01}$	$5.61750\times10^{+01}$	$4.14246\times10^{+01}$	$5.93541\times10^{+01}$
7000	$8.31325\times10^{+01}$	$6.73473\times10^{+01}$	$5.84479\times10^{+01}$	$4.40176\times10^{+01}$	$5.94653\times10^{+01}$
7500	$8.33625\times10^{+01}$	$6.80052\times10^{+01}$	$6.04388\times10^{+01}$	$4.62732\times10^{+01}$	$5.95687\times10^{+01}$
8000	$8.35788\times10^{+01}$	$6.85909\times10^{+01}$	$6.21991\times10^{+01}$	$4.82542\times10^{+01}$	$5.96655\times10^{+01}$

Table VII

$\ln$ of partition functions

T°K	$\frac{\partial}{\partial T}\ln f_{N_2}$	$\frac{\partial}{\partial T}\ln f_N$	$\frac{\partial}{\partial T}\ln f_{N_2^+}$	$\frac{\partial}{\partial T}\ln f_{N^+}$	$\frac{\partial}{\partial T}\ln f_{e^-}$
2000	1.44635×10^{-03}	1.48966×10^{-02}	4.66445×10^{-02}	5.70956×10^{-02}	7.50000×10^{-04}
2500	1.19422×10^{-03}	9.65404×10^{-03}	3.01424×10^{-02}	3.66615×10^{-02}	6.00000×10^{-04}
3000	1.01907×10^{-03}	6.78817×10^{-03}	2.11487×10^{-02}	2.55434×10^{-02}	5.00000×10^{-04}
3500	8.89670×10^{-04}	5.05001×10^{-03}	1.57067×10^{-02}	1.88291×10^{-02}	4.28571×10^{-04}
4000	7.89908×10^{-04}	3.91607×10^{-03}	1.21604×10^{-02}	1.44646×10^{-02}	3.75000×10^{-04}
4500	7.10549×10^{-04}	3.13531×10^{-03}	9.71771×10^{-03}	1.14680×10^{-02}	3.33333×10^{-04}
5000	6.45874×10^{-04}	2.57492×10^{-03}	7.96111×10^{-03}	9.32142×10^{-03}	3.00000×10^{-04}
5500	5.92141×10^{-04}	2.15915×10^{-03}	6.65386×10^{-03}	7.73089×10^{-03}	2.72727×10^{-04}
6000	5.46805×10^{-04}	1.84216×10^{-03}	5.65347×10^{-03}	6.51939×10^{-03}	2.50000×10^{-04}
6500	5.08079×10^{-04}	1.59488×10^{-03}	4.86999×10^{-03}	5.57514×10^{-03}	2.30769×10^{-04}
7000	4.74679×10^{-04}	1.39813×10^{-03}	4.24432×10^{-03}	4.82474×10^{-03}	2.14285×10^{-04}
7500	4.45665×10^{-04}	1.23888×10^{-03}	3.73631×10^{-03}	4.21840×10^{-03}	2.00000×10^{-04}
8000	4.20338×10^{-04}	1.10800×10^{-03}	3.31787×10^{-03}	3.72134×10^{-03}	1.87500×10^{-04}

Table VIII

Temperature derivatives of $\ln$ of partition functions

T°K	$\frac{\partial}{\partial T} T^2 \frac{\partial}{\partial T} \ln f_{N_2}$	$\frac{\partial}{\partial T} T^2 \frac{\partial}{\partial T} \ln f_N$	$\frac{\partial}{\partial T} T^2 \frac{\partial}{\partial T} \ln f_{N_2^+}$	$\frac{\partial}{\partial T} T^2 \frac{\partial}{\partial T} \ln f_{N^+}$	$\frac{\partial}{\partial T} T^2 \frac{\partial}{\partial T} \ln f_e$
2000	$3.31652 \times 10^{+00}$	$1.50047 \times 10^{+00}$	$3.49102 \times 10^{+00}$	$1.74195 \times 10^{+00}$	$1.50000 \times 10^{+00}$
2500	$3.39090 \times 10^{+00}$	$1.50482 \times 10^{+00}$	$3.76172 \times 10^{+00}$	$1.69263 \times 10^{+00}$	$1.50000 \times 10^{+00}$
3000	$3.43699 \times 10^{+00}$	$1.52134 \times 10^{+00}$	$4.02630 \times 10^{+00}$	$1.52053 \times 10^{+00}$	$1.50000 \times 10^{+00}$
3500	$3.46821 \times 10^{+00}$	$1.55916 \times 10^{+00}$	$4.24048 \times 10^{+00}$	$1.54202 \times 10^{+00}$	$1.50000 \times 10^{+00}$
4000	$3.49100 \times 10^{+00}$	$1.62320 \times 10^{+00}$	$4.38634 \times 10^{+00}$	$1.56987 \times 10^{+00}$	$1.50000 \times 10^{+00}$
4500	$3.50878 \times 10^{+00}$	$1.71262 \times 10^{+00}$	$4.46839 \times 10^{+00}$	$1.60105 \times 10^{+00}$	$1.50000 \times 10^{+00}$
5000	$3.52378 \times 10^{+00}$	$1.82210 \times 10^{+00}$	$4.50123 \times 10^{+00}$	$1.63277 \times 10^{+00}$	$1.50000 \times 10^{+00}$
5500	$3.53791 \times 10^{+00}$	$1.94395 \times 10^{+00}$	$4.50063 \times 10^{+00}$	$1.66300 \times 10^{+00}$	$1.50000 \times 10^{+00}$
6000	$3.55337 \times 10^{+00}$	$2.06994 \times 10^{+00}$	$4.47959 \times 10^{+00}$	$1.69056 \times 10^{+00}$	$1.50000 \times 10^{+00}$
6500	$3.57301 \times 10^{+00}$	$2.19260 \times 10^{+00}$	$4.44745 \times 10^{+00}$	$1.71490 \times 10^{+00}$	$1.50000 \times 10^{+00}$
7000	$3.60038 \times 10^{+00}$	$2.30598 \times 10^{+00}$	$4.41040 \times 10^{+00}$	$1.73594 \times 10^{+00}$	$1.50000 \times 10^{+00}$
7500	$3.63964 \times 10^{+00}$	$2.40591 \times 10^{+00}$	$4.37228 \times 10^{+00}$	$1.75391 \times 10^{+00}$	$1.50000 \times 10^{+00}$
8000	$3.69537 \times 10^{+00}$	$2.49000 \times 10^{+00}$	$4.33533 \times 10^{+00}$	$1.76915 \times 10^{+00}$	$1.50000 \times 10^{+00}$

Table IX Temperature derivatives of the product of T^2 and temperature derivatives of $\ln$ of partition functions

$\log p/p_0 = -3.0$

T°K	X_{N_2}	X_N	$X_{N_2^+}$	X_{N^+}	X_{e^-}
2000	$1.00000\times10^{+00}$	1.09740×10^{-08}	4.58188×10^{-18}	2.01225×10^{-23}	4.58190×10^{-18}
2500	9.99996×10^{-01}	3.16842×10^{-06}	4.57848×10^{-14}	1.73945×10^{-17}	4.58022×10^{-14}
3000	9.99862×10^{-01}	1.37524×10^{-04}	2.18415×10^{-11}	1.59341×10^{-13}	2.20008×10^{-11}
3500	9.97979×10^{-01}	2.02042×10^{-03}	1.79034×10^{-09}	1.05873×10^{-10}	1.89621×10^{-09}
4000	9.85016×10^{-01}	1.49830×10^{-02}	4.57319×10^{-08}	1.28089×10^{-08}	5.85409×10^{-08}
4500	9.31317×10^{-01}	6.86804×10^{-02}	4.89028×10^{-07}	4.57769×10^{-07}	9.46798×10^{-07}
5000	7.87675×10^{-01}	2.12305×10^{-01}	2.64573×10^{-06}	6.64251×10^{-06}	9.28825×10^{-06}
5500	5.43565×10^{-01}	4.56319×10^{-01}	8.20502×10^{-06}	4.92828×10^{-05}	5.74879×10^{-05}
6000	2.87342×10^{-01}	7.12177×10^{-01}	1.59174×10^{-05}	2.24437×10^{-04}	2.40354×10^{-04}
6500	1.18484×10^{-01}	8.79990×10^{-01}	2.14618×10^{-05}	7.40680×10^{-04}	7.62142×10^{-04}
7000	4.28713×10^{-02}	9.53088×10^{-01}	2.31604×10^{-05}	1.99669×10^{-03}	2.01985×10^{-03}
7500	1.55955×10^{-02}	9.75009×10^{-01}	2.27033×10^{-05}	4.67484×10^{-03}	4.69754×10^{-03}
8000	6.08031×10^{-03}	9.74286×10^{-01}	2.15355×10^{-05}	9.79523×10^{-03}	9.81676×10^{-03}

$\log p/p_0 = -2.0$

T°K	X_{N_2}	X_N	$X_{N_2^+}$	X_{N^+}	X_{e^-}
2000	$1.00000\times10^{+00}$	3.47030×10^{-09}	1.44892×10^{-18}	2.01225×10^{-24}	1.44892×10^{-18}
2500	9.99999×10^{-01}	1.00194×10^{-06}	1.44803×10^{-14}	1.73968×10^{-18}	1.44821×10^{-14}
3000	9.99956×10^{-01}	4.34922×10^{-05}	6.92455×10^{-12}	1.59745×10^{-14}	6.94052×10^{-12}
3500	9.99360×10^{-01}	6.39578×10^{-04}	5.77883×10^{-10}	1.08028×10^{-11}	5.88686×10^{-10}
4000	9.95225×10^{-01}	4.77476×10^{-03}	1.58055×10^{-08}	1.39629×10^{-09}	1.72018×10^{-08}
4500	9.77484×10^{-01}	2.25148×10^{-02}	1.96217×10^{-07}	5.73686×10^{-08}	2.53586×10^{-07}
5000	9.24526×10^{-01}	7.54686×10^{-02}	1.32814×10^{-06}	1.00986×10^{-06}	2.33800×10^{-06}
5500	8.09332×10^{-01}	1.90638×10^{-01}	5.53695×10^{-06}	9.33151×10^{-06}	1.48684×10^{-05}
6000	6.26178×10^{-01}	3.73684×10^{-01}	1.54810×10^{-05}	5.25581×10^{-05}	6.80392×10^{-05}
6500	4.14268×10^{-01}	5.85263×10^{-01}	3.09262×10^{-05}	2.03023×10^{-04}	2.33949×10^{-04}
7000	2.33394×10^{-01}	7.65318×10^{-01}	4.68952×10^{-05}	5.96318×10^{-04}	6.43213×10^{-04}
7500	1.15624×10^{-01}	8.81358×10^{-01}	5.77775×10^{-05}	1.45053×10^{-03}	1.50830×10^{-03}
8000	5.36748×10^{-02}	9.40006×10^{-01}	6.22947×10^{-05}	3.09678×10^{-03}	3.15908×10^{-03}

Table X Mole Fractions

$\log P/P_0 = -1.0$

T°K	X_{N_2}	X_N	$X_{N_2^+}$	X_{N^+}	X_{e^-}
2000	$1.00000\times10^{+00}$	1.09740×10^{-09}	4.58189×10^{-19}	2.01225×10^{-25}	4.58189×10^{-19}
2500	9.99999×10^{-01}	3.16843×10^{-07}	4.57928×10^{-15}	1.73975×10^{-19}	4.57945×10^{-15}
3000	9.99986×10^{-01}	1.37537×10^{-05}	2.19151×10^{-12}	1.59873×10^{-15}	2.19310×10^{-12}
3500	9.99797×10^{-01}	2.02318×10^{-04}	1.83960×10^{-10}	1.08736×10^{-12}	1.85048×10^{-10}
4000	9.98486×10^{-01}	1.51362×10^{-03}	5.15559×10^{-09}	1.43910×10^{-10}	5.29950×10^{-09}
4500	9.92796×10^{-01}	7.20309×10^{-03}	6.82891×10^{-08}	6.28909×10^{-09}	7.45782×10^{-08}
5000	9.75168×10^{-01}	2.48305×10^{-02}	5.21253×10^{-07}	1.23630×10^{-07}	6.44884×10^{-07}
5500	9.33084×10^{-01}	6.69073×10^{-02}	2.58885×10^{-06}	1.32818×10^{-06}	3.91703×10^{-06}
6000	8.52765×10^{-01}	1.47198×10^{-01}	9.08088×10^{-06}	8.91729×10^{-06}	1.79981×10^{-05}
6500	7.28520×10^{-01}	2.71349×10^{-01}	2.38649×10^{-05}	4.13043×10^{-05}	6.51693×10^{-05}
7000	5.71869×10^{-01}	4.27747×10^{-01}	4.91497×10^{-05}	1.42563×10^{-04}	1.91713×10^{-04}
7500	4.09340×10^{-01}	5.89712×10^{-01}	8.24086×10^{-05}	3.91017×10^{-04}	4.73425×10^{-04}
8000	2.68189×10^{-01}	7.29776×10^{-01}	1.16601×10^{-04}	9.00643×10^{-04}	1.01724×10^{-03}

$\log P/P_0 = 0$

T°K	X_{N_2}	X_N	$X_{N_2^+}$	X_{N^+}	X_{e^-}
2000	$1.00000\times10^{+00}$	3.47030×10^{-10}	1.44892×10^{-19}	2.01225×10^{-26}	1.44892×10^{-19}
2500	9.99999×10^{-01}	1.00194×10^{-07}	1.44811×10^{-15}	1.73977×10^{-20}	1.44813×10^{-15}
3000	9.99995×10^{-01}	4.34935×10^{-06}	6.93194×10^{-13}	1.59914×10^{-16}	6.93354×10^{-13}
3500	9.99936×10^{-01}	6.39854×10^{-05}	5.82967×10^{-11}	1.08963×10^{-13}	5.84056×10^{-11}
4000	9.99521×10^{-01}	4.79020×10^{-04}	1.64697×10^{-09}	1.45340×10^{-11}	1.66150×10^{-09}
4500	9.97713×10^{-01}	2.28626×10^{-03}	2.23287×10^{-08}	6.49474×10^{-10}	2.29781×10^{-08}
5000	9.92046×10^{-01}	7.95353×10^{-03}	1.79142×10^{-07}	1.33782×10^{-08}	1.92521×10^{-07}
5500	9.78084×10^{-01}	2.19128×10^{-02}	9.68218×10^{-07}	1.55200×10^{-07}	1.12341×10^{-06}
6000	9.49602×10^{-01}	5.03875×10^{-02}	3.83543×10^{-06}	1.15778×10^{-06}	4.99322×10^{-06}
6500	8.99972×10^{-01}	9.99915×10^{-02}	1.18017×10^{-05}	6.09298×10^{-06}	1.78947×10^{-05}
7000	8.24848×10^{-01}	1.75044×10^{-01}	2.94212×10^{-05}	2.42121×10^{-05}	5.36333×10^{-05}
7500	7.25096×10^{-01}	2.74628×10^{-01}	6.13583×10^{-05}	7.65403×10^{-05}	1.37898×10^{-04}
8000	6.07998×10^{-01}	3.91379×10^{-01}	1.09848×10^{-04}	2.00718×10^{-04}	3.10566×10^{-04}

Table X Mole fractions

$T\,°K$	X_{N_2}	X_N	$X_{N_2^+}$	X_{N^+}	X_{e^-}
2000	$1.00000 \times 10^{+00}$	1.09740×10^{-10}	4.58189×10^{-20}	2.01225×10^{-27}	4.58189×10^{-20}
2500	$1.00000 \times 10^{+00}$	3.16843×10^{-08}	4.57936×10^{-16}	1.73978×10^{-21}	4.57937×10^{-16}
3000	9.99998×10^{-01}	1.37539×10^{-06}	2.19224×10^{-13}	1.59926×10^{-17}	2.19240×10^{-13}
3500	9.99979×10^{-01}	2.02346×10^{-05}	1.84474×10^{-11}	1.09035×10^{-14}	1.84583×10^{-11}
4000	9.99848×10^{-01}	1.51516×10^{-04}	5.22512×10^{-10}	1.45801×10^{-12}	5.23970×10^{-10}
4500	9.99276×10^{-01}	7.23829×10^{-04}	7.13858×10^{-09}	6.56357×10^{-11}	7.20421×10^{-09}
5000	9.97474×10^{-01}	2.52543×10^{-03}	5.82845×10^{-08}	1.37454×10^{-09}	5.96590×10^{-08}
5500	9.92991×10^{-01}	7.00831×10^{-03}	3.25442×10^{-07}	1.64339×10^{-08}	3.41876×10^{-07}
6000	9.83639×10^{-01}	1.63579×10^{-02}	1.35792×10^{-06}	1.28469×10^{-07}	1.48638×10^{-06}
6500	9.66648×10^{-01}	3.33405×10^{-02}	4.49848×10^{-06}	7.20975×10^{-07}	5.21946×10^{-06}
7000	9.39085×10^{-01}	6.08837×10^{-02}	1.23509×10^{-05}	3.10523×10^{-06}	1.54561×10^{-05}
7500	8.98502×10^{-01}	1.01417×10^{-01}	2.90032×10^{-05}	1.07822×10^{-05}	3.97855×10^{-05}
8000	8.43695×10^{-01}	1.56122×10^{-01}	5.96578×10^{-05}	3.13362×10^{-05}	9.09940×10^{-05}

$\log \rho/\rho_0 = 1.0$

Table X Mole fractions

log $\rho/\rho_0 = -3.0$

T°K	$\frac{\partial X_{N_2}}{\partial T}$	$\frac{\partial X_{N}}{\partial T}$	$\frac{\partial X_{N_2^+}}{\partial T}$	$\frac{\partial X_{N^+}}{\partial T}$	$\frac{\partial X_{e^-}}{\partial T}$
2000	-1.55541×10^{-10}	1.55541×10^{-10}	1.05264×10^{-19}	6.87152×10^{-25}	1.05265×10^{-19}
2500	-2.86961×10^{-08}	2.86961×10^{-08}	6.76368×10^{-16}	3.80749×10^{-19}	6.76749×10^{-16}
3000	-8.63381×10^{-07}	8.63380×10^{-07}	2.24889×10^{-13}	2.42214×10^{-15}	2.27311×10^{-13}
3500	-9.29036×10^{-06}	9.29033×10^{-06}	1.34565×10^{-11}	1.17368×10^{-12}	1.46302×10^{-11}
4000	-5.21641×10^{-05}	5.21634×10^{-05}	2.53191×10^{-10}	1.05659×10^{-10}	3.58850×10^{-10}
4500	-1.81048×10^{-04}	1.81039×10^{-04}	1.95856×10^{-09}	2.82027×10^{-09}	4.77883×10^{-09}
5000	-4.00440×10^{-04}	4.00364×10^{-04}	7.37815×10^{-09}	3.06493×10^{-08}	3.80275×10^{-08}
5500	-5.42564×10^{-04}	5.42194×10^{-04}	1.44835×10^{-08}	1.70596×10^{-07}	1.85080×10^{-07}
6000	-4.44488×10^{-04}	4.43265×10^{-04}	1.46387×10^{-08}	5.96897×10^{-07}	6.11536×10^{-07}
6500	-2.31539×10^{-04}	2.28330×10^{-04}	6.97024×10^{-09}	1.59746×10^{-06}	1.60443×10^{-06}
7000	-8.84382×10^{-05}	8.11327×10^{-05}	5.59510×10^{-10}	3.65218×10^{-06}	3.65274×10^{-06}
7500	-3.06000×10^{-05}	1.58024×10^{-05}	-1.90906×10^{-09}	7.40071×10^{-06}	7.39881×10^{-06}
8000	-1.09696×10^{-05}	-1.60896×10^{-05}	-2.62454×10^{-09}	1.35322×10^{-05}	1.35296×10^{-05}

log $\rho/\rho_0 = 2.0$

T°K	$\frac{\partial X_{N_2}}{\partial T}$	$\frac{\partial X_{N}}{\partial T}$	$\frac{\partial X_{N_2^+}}{\partial T}$	$\frac{\partial X_{N^+}}{\partial T}$	$\frac{\partial X_{e^-}}{\partial T}$
2000	-4.91864×10^{-11}	4.91864×10^{-11}	3.32876×10^{-20}	6.87153×10^{-26}	3.32877×10^{-20}
2500	-9.07455×10^{-09}	9.07455×10^{-09}	2.13928×10^{-16}	3.80815×10^{-20}	2.13966×10^{-16}
3000	-2.73063×10^{-07}	2.73063×10^{-07}	7.13851×10^{-14}	2.43025×10^{-16}	7.16281×10^{-14}
3500	-2.94397×10^{-06}	2.94396×10^{-06}	4.38492×10^{-12}	1.20514×10^{-13}	4.50543×10^{-12}
4000	-1.67525×10^{-05}	1.67523×10^{-05}	9.08891×10^{-11}	1.18040×10^{-11}	1.02693×10^{-10}
4500	-6.15356×10^{-05}	6.15331×10^{-05}	8.60069×10^{-10}	3.73167×10^{-10}	1.23323×10^{-09}
5000	-1.60288×10^{-04}	1.60269×10^{-04}	4.39088×10^{-09}	5.08397×10^{-09}	9.47486×10^{-09}
5500	-3.03532×10^{-04}	3.03432×10^{-04}	1.34681×10^{-08}	3.64782×10^{-08}	4.99463×10^{-08}
6000	-4.15044×10^{-04}	4.14671×10^{-04}	2.63259×10^{-08}	1.59965×10^{-07}	1.86291×10^{-07}
6500	-4.10638×10^{-04}	4.09598×10^{-04}	3.36224×10^{-08}	4.86569×10^{-07}	5.20191×10^{-07}
7000	-3.01835×10^{-04}	2.99463×10^{-04}	2.81658×10^{-08}	1.15811×10^{-06}	1.18627×10^{-06}
7500	-1.72723×10^{-04}	1.67957×10^{-04}	1.49934×10^{-08}	2.36838×10^{-06}	2.38337×10^{-06}
8000	-8.33765×10^{-05}	7.46255×10^{-05}	3.93050×10^{-09}	4.37157×10^{-06}	4.37550×10^{-06}

Table XI Temperature derivatives of mole fractions (density constant)

$\log \rho/\rho_0 = -1.0$

T°K	$\frac{\partial X_{N_2}}{\partial T}$	$\frac{\partial X_N}{\partial T}$	$\frac{\partial X_{N_2^+}}{\partial T}$	$\frac{\partial X_{N^+}}{\partial T}$	$\frac{\partial X_{e^-}}{\partial T}$
2000	-1.55541×10^{-11}	1.55541×10^{-11}	1.05264×10^{-20}	6.87153×10^{-27}	1.05264×10^{-20}
2500	-2.86963×10^{-09}	2.86963×10^{-09}	6.76542×10^{-17}	3.80836×10^{-21}	6.76580×10^{-17}
3000	-8.63541×10^{-08}	8.63541×10^{-08}	2.26010×10^{-14}	2.43284×10^{-17}	2.26253×10^{-14}
3500	-9.31576×10^{-07}	9.31573×10^{-07}	1.40024×10^{-12}	1.21557×10^{-14}	1.41240×10^{-12}
4000	-5.32365×10^{-06}	5.32359×10^{-06}	3.00680×10^{-11}	1.22792×10^{-12}	3.12960×10^{-11}
4500	-1.99173×10^{-05}	1.99166×10^{-05}	3.11824×10^{-10}	4.19911×10^{-11}	3.53815×10^{-10}
5000	-5.48796×10^{-05}	5.48745×10^{-05}	1.87801×10^{-09}	6.55288×10^{-10}	2.53330×10^{-09}
5500	-1.18386×10^{-04}	1.18360×10^{-04}	7.33889×10^{-09}	5.63247×10^{-09}	1.29713×10^{-08}
6000	-2.05161×10^{-04}	2.05060×10^{-04}	2.00174×10^{-08}	3.03953×10^{-08}	5.04127×10^{-08}
6500	-2.87915×10^{-04}	2.87608×10^{-04}	3.99793×10^{-08}	1.13533×10^{-07}	1.53513×10^{-07}
7000	-3.29284×10^{-04}	3.28528×10^{-04}	6.03112×10^{-08}	3.17618×10^{-07}	3.77930×10^{-07}
7500	-3.11257×10^{-04}	3.09688×10^{-04}	7.02139×10^{-08}	7.14165×10^{-07}	7.84379×10^{-07}
8000	-2.48329×10^{-04}	2.45452×10^{-04}	6.39023×10^{-08}	1.37449×10^{-06}	1.43839×10^{-06}

$\log \rho/\rho_0 = 0$

T°K	$\frac{\partial X_{N_2}}{\partial T}$	$\frac{\partial X_N}{\partial T}$	$\frac{\partial X_{N_2^+}}{\partial T}$	$\frac{\partial X_{N^+}}{\partial T}$	$\frac{\partial X_{e^-}}{\partial T}$
2000	-4.91864×10^{-12}	4.91864×10^{-12}	3.32876×10^{-21}	6.87154×10^{-28}	3.32876×10^{-21}
2500	-9.07457×10^{-10}	9.07457×10^{-10}	2.13945×10^{-17}	3.80842×10^{-22}	2.13949×10^{-17}
3000	-2.73079×10^{-08}	2.73079×10^{-08}	7.14977×10^{-15}	2.43365×10^{-18}	7.15221×10^{-15}
3500	-2.94651×10^{-07}	2.94650×10^{-07}	4.44180×10^{-13}	1.21892×10^{-15}	4.45398×10^{-13}
4000	-1.68610×10^{-06}	1.68608×10^{-06}	9.65079×10^{-12}	1.24400×10^{-13}	9.77519×10^{-12}
4500	-6.34522×10^{-06}	6.34501×10^{-06}	1.03509×10^{-10}	4.37931×10^{-12}	1.07888×10^{-10}
5000	-1.78058×10^{-05}	1.78043×10^{-05}	6.69194×10^{-10}	7.25540×10^{-11}	7.41748×10^{-10}
5500	-4.01603×10^{-05}	4.01530×10^{-05}	2.94433×10^{-09}	6.86680×10^{-10}	3.63101×10^{-09}
6000	-7.60719×10^{-05}	7.60444×10^{-05}	9.52838×10^{-09}	4.21916×10^{-09}	1.37475×10^{-08}
6500	-1.24005×10^{-04}	1.23920×10^{-04}	2.39025×10^{-08}	1.84055×10^{-08}	4.23081×10^{-08}
7000	-1.76251×10^{-04}	1.76033×10^{-04}	4.82219×10^{-08}	6.09010×10^{-08}	1.09123×10^{-07}
7500	-2.20262×10^{-04}	2.19779×10^{-04}	8.03484×10^{-08}	1.60919×10^{-07}	2.41267×10^{-07}
8000	-2.44036×10^{-04}	2.43102×10^{-04}	1.12840×10^{-07}	3.54381×10^{-07}	4.67222×10^{-07}

Table XI (Cont.) Temperature derivatives of mole fractions (density constant)

T °K	$\frac{\partial X_{N_2}}{\partial T}$	$\frac{\partial X_N}{\partial T}$	$\frac{\partial X_{N_2^+}}{\partial T}$	$\frac{\partial X_{N^+}}{\partial T}$	$\frac{\partial X_{e^-}}{\partial T}$
2000	-1.55541×10^{-12}	1.55541×10^{-12}	1.05264×10^{-21}	6.87154×10^{-29}	1.05264×10^{-21}
2500	-2.86963×10^{-10}	2.86963×10^{-10}	6.76559×10^{-18}	3.80844×10^{-23}	6.76563×10^{-18}
3000	-8.63557×10^{-09}	8.63557×10^{-09}	2.26122×10^{-15}	2.43391×10^{-19}	2.26147×10^{-15}
3500	-9.31830×10^{-08}	9.31828×10^{-08}	1.40601×10^{-13}	1.21998×10^{-16}	1.40723×10^{-13}
4000	-5.33455×10^{-07}	5.33449×10^{-07}	3.06643×10^{-12}	1.24920×10^{-14}	3.07892×10^{-12}
4500	-2.01125×10^{-06}	2.01118×10^{-06}	3.32597×10^{-11}	4.44040×10^{-13}	3.37037×10^{-11}
5000	-5.67693×10^{-06}	5.67647×10^{-06}	2.20545×10^{-10}	7.51685×10^{-12}	2.28062×10^{-10}
5500	-1.29905×10^{-05}	1.29883×10^{-05}	1.01679×10^{-09}	7.39646×10^{-11}	1.09076×10^{-09}
6000	-2.53543×10^{-05}	2.53462×10^{-05}	3.54354×10^{-09}	4.82447×10^{-10}	4.02599×10^{-09}
6500	-4.36070×10^{-05}	4.35827×10^{-05}	9.87715×10^{-09}	2.28283×10^{-09}	1.21599×10^{-08}
7000	-6.74889×10^{-05}	6.74264×10^{-05}	2.29062×10^{-08}	8.35590×10^{-09}	3.12621×10^{-08}
7500	-9.52650×10^{-05}	9.51244×10^{-05}	4.54745×10^{-08}	2.48072×10^{-08}	7.02818×10^{-08}
8000	-1.23760×10^{-04}	1.23478×10^{-04}	7.89326×10^{-08}	6.19356×10^{-08}	1.40868×10^{-07}

$\log \rho/\rho_0 = 1.0$

Table XI (Cont.) Temperature derivatives of mole fractions (density constant)

$\log \rho/\rho_0 = -3.0$

T°K	$\frac{\partial x_{N_2}}{\partial \rho/\rho_0}$	$\frac{\partial x_{N}}{\partial \rho/\rho_0}$	$\frac{\partial x_{N_2^+}}{\partial \rho/\rho_0}$	$\frac{\partial x_{N^+}}{\partial \rho/\rho_0}$	$\frac{\partial x_{e^-}}{\partial \rho/\rho_0}$
2000	5.48703×10^{-06}	-5.48703×10^{-06}	-2.29093×10^{-15}	-2.01225×10^{-20}	-2.29095×10^{-15}
2500	1.58421×10^{-03}	-1.58421×10^{-03}	-2.28880×10^{-11}	-1.73929×10^{-14}	-2.29054×10^{-11}
3000	6.87554×10^{-02}	-6.87554×10^{-02}	-1.08800×10^{-08}	-1.59047×10^{-10}	-1.10391×10^{-08}
3500	$1.00868\times10^{+00}$	$-1.00868\times10^{+00}$	-8.68811×10^{-07}	-1.04341×10^{-07}	-9.73152×10^{-07}
4000	$7.40728\times10^{+00}$	$-7.40722\times10^{+00}$	-2.00976×10^{-05}	-1.20578×10^{-05}	-3.21554×10^{-05}
4500	$3.25617\times10^{+01}$	$-3.25606\times10^{+01}$	-1.71662×10^{-04}	-3.93718×10^{-04}	-5.65380×10^{-04}
5000	$8.89041\times10^{+01}$	$-8.88928\times10^{+01}$	-6.04889×10^{-04}	-5.04957×10^{-03}	-5.65446×10^{-03}
5500	$1.45598\times10^{+02}$	$-1.45532\times10^{+02}$	-5.53305×10^{-04}	-3.22388×10^{-02}	-3.27921×10^{-02}
6000	$1.41683\times10^{+02}$	$-1.41433\times10^{+02}$	1.97589×10^{-03}	-1.27277×10^{-01}	-1.25301×10^{-01}
6500	$8.65565\times10^{+01}$	$-8.57970\times10^{+01}$	6.50827×10^{-03}	-3.86241×10^{-01}	-3.79733×10^{-01}
7000	$3.89261\times10^{+01}$	$-3.69269\times10^{+01}$	9.66736×10^{-03}	$-1.00928\times10^{+00}$	-9.99620×10^{-01}
7500	$1.72504\times10^{+01}$	$-1.26051\times10^{+01}$	1.06384×10^{-02}	$-2.33329\times10^{+00}$	$-2.32265\times10^{+00}$
8000	$1.08882\times10^{+01}$	$-1.23512\times10^{+00}$	1.05336×10^{-02}	$-4.83708\times10^{+00}$	$-4.82654\times10^{+00}$

$\log \rho/\rho_0 = -2.0$

T°K	$\frac{\partial x_{N_2}}{\partial \rho/\rho_0}$	$\frac{\partial x_{N}}{\partial \rho/\rho_0}$	$\frac{\partial x_{N_2^+}}{\partial \rho/\rho_0}$	$\frac{\partial x_{N^+}}{\partial \rho/\rho_0}$	$\frac{\partial x_{e^-}}{\partial \rho/\rho_0}$
2000	1.73515×10^{-07}	-1.73515×10^{-07}	-7.24460×10^{-17}	-2.01225×10^{-22}	-7.24462×10^{-17}
2500	5.00972×10^{-05}	-5.00972×10^{-05}	-7.23973×10^{-13}	-1.73963×10^{-16}	-7.24147×10^{-13}
3000	2.17454×10^{-03}	-2.17454×10^{-03}	-3.45817×10^{-10}	-1.59651×10^{-12}	-3.47414×10^{-10}
3500	3.19636×10^{-02}	-3.19635×10^{-02}	-2.86151×10^{-08}	-1.07516×10^{-09}	-2.96903×10^{-08}
4000	2.37884×10^{-01}	-2.37883×10^{-01}	-7.55333×10^{-07}	-1.36626×10^{-07}	-8.91960×10^{-07}
4500	$1.10672\times10^{+00}$	$-1.10669\times10^{+00}$	-8.52878×10^{-06}	-5.37843×10^{-06}	-1.39072×10^{-05}
5000	$3.55868\times10^{+00}$	$-3.55841\times10^{+00}$	-4.79945×10^{-05}	-8.79959×10^{-05}	-1.35990×10^{-04}
5500	$8.14531\times10^{+00}$	$-8.14355\times10^{+00}$	-1.44817×10^{-04}	-7.36584×10^{-04}	-8.81401×10^{-04}
6000	$1.32265\times10^{+01}$	$-1.32187\times10^{+01}$	-2.09856×10^{-04}	-3.68147×10^{-03}	-3.89132×10^{-03}
6500	$1.53110\times10^{+01}$	$-1.52859\times10^{+01}$	3.82705×10^{-05}	-1.25484×10^{-02}	-1.25101×10^{-02}
7000	$1.30095\times10^{+01}$	$-1.29445\times10^{+01}$	7.82970×10^{-04}	-3.32806×10^{-02}	-3.24976×10^{-02}
7500	$8.54363\times10^{+00}$	$-8.39488\times10^{+00}$	1.74832×10^{-03}	-7.61223×10^{-02}	-7.43740×10^{-02}
8000	$4.76786\times10^{+00}$	$-4.45742\times10^{+00}$	2.46998×10^{-03}	-1.57687×10^{-01}	-1.55217×10^{-01}

Table XII Density derivatives of mole fractions (temperature constant)

$\log \rho/\rho_0 = -1.0$

T°K	$\frac{\partial X_{N_2}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N_2^+}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N^+}}{\partial \rho/\rho_0}$	$\frac{\partial X_{e^-}}{\partial \rho/\rho_0}$
2000	5.48703×10^{-09}	-5.48703×10^{-09}	-2.29094×10^{-18}	-2.01225×10^{-24}	-2.29095×10^{-18}
2500	1.58421×10^{-06}	-1.58421×10^{-06}	-2.28959×10^{-14}	-1.73974×10^{-18}	-2.28977×10^{-14}
3000	6.87681×10^{-05}	-6.87681×10^{-05}	-1.09534×10^{-11}	-1.59843×10^{-14}	-1.09694×10^{-11}
3500	1.01144×10^{-03}	-1.01144×10^{-03}	-9.16961×10^{-10}	-1.08571×10^{-11}	-9.27818×10^{-10}
4000	7.55957×10^{-03}	-7.55951×10^{-03}	-2.53985×10^{-08}	-1.42878×10^{-09}	-2.68273×10^{-08}
4500	3.58215×10^{-02}	-3.58207×10^{-02}	-3.25177×10^{-07}	-6.14495×10^{-08}	-3.86626×10^{-07}
5000	1.21842×10^{-01}	-1.21835×10^{-01}	-2.30622×10^{-06}	-1.16905×10^{-06}	-3.47527×10^{-06}
5500	3.17693×10^{-01}	-3.17649×10^{-01}	-1.00576×10^{-05}	-1.19178×10^{-05}	-2.19754×10^{-05}
6000	6.53807×10^{-01}	-6.53601×10^{-01}	-2.86084×10^{-05}	-7.45237×10^{-05}	-1.03132×10^{-04}
6500	$1.07338\times10^{+00}$	$-1.07264\times10^{+00}$	-5.33043×10^{-05}	-3.16366×10^{-04}	-3.69670×10^{-04}
7000	$1.41791\times10^{+00}$	$-1.41582\times10^{+00}$	-5.69228×10^{-05}	-9.90168×10^{-04}	-1.04709×10^{-03}
7500	$1.53139\times10^{+00}$	$-1.52647\times10^{+00}$	1.86361×10^{-06}	-2.46349×10^{-03}	-2.46163×10^{-03}
8000	$1.38389\times10^{+00}$	$-1.37374\times10^{+00}$	1.42940×10^{-04}	-5.21973×10^{-03}	-5.07679×10^{-03}

$\log \rho/\rho_0 = 0$

T°K	$\frac{\partial X_{N_2}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N_2^+}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N^+}}{\partial \rho/\rho_0}$	$\frac{\partial X_{e^-}}{\partial \rho/\rho_0}$
2000	1.73515×10^{-10}	-1.73515×10^{-10}	-7.24461×10^{-20}	-2.01225×10^{-26}	-7.24461×10^{-20}
2500	5.00973×10^{-08}	-5.00973×10^{-08}	-7.24053×10^{-16}	-1.73977×10^{-20}	-7.24070×10^{-16}
3000	2.17467×10^{-06}	-2.17467×10^{-06}	-3.46555×10^{-13}	-1.59904×10^{-16}	-3.46715×10^{-13}
3500	3.19912×10^{-05}	-3.19911×10^{-05}	-2.91197×10^{-11}	-1.08911×10^{-13}	-2.92286×10^{-11}
4000	2.39426×10^{-04}	-2.39424×10^{-04}	-8.19589×10^{-10}	-1.45005×10^{-11}	-8.34089×10^{-10}
4500	1.14119×10^{-03}	-1.14117×10^{-03}	-1.09873×10^{-08}	-6.44511×10^{-10}	-1.16318×10^{-08}
5000	3.95322×10^{-03}	-3.95303×10^{-03}	-8.59184×10^{-08}	-1.31188×10^{-08}	-9.90372×10^{-08}
5500	1.07771×10^{-02}	-1.07760×10^{-02}	-4.42511×10^{-07}	-1.48965×10^{-07}	-5.91476×10^{-07}
6000	2.42427×10^{-02}	-2.42373×10^{-02}	-1.61968×10^{-06}	-1.07539×10^{-06}	-2.69507×10^{-06}
6500	4.62313×10^{-02}	-4.62116×10^{-02}	-4.42251×10^{-06}	-5.41204×10^{-06}	-9.83456×10^{-06}
7000	7.58921×10^{-02}	-7.58329×10^{-02}	-9.25823×10^{-06}	-2.03347×10^{-05}	-2.95929×10^{-05}
7500	1.08338×10^{-01}	-1.08187×10^{-01}	-1.49215×10^{-05}	-6.01917×10^{-05}	-7.51133×10^{-05}
8000	1.35822×10^{-01}	-1.35492×10^{-01}	-1.78221×10^{-05}	-1.46822×10^{-04}	-1.64644×10^{-04}

Table XII (Cont.) Density derivatives of mole fractions (temperature constant)

T°K	$\frac{\partial X_{N_2}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N_2^+}}{\partial \rho/\rho_0}$	$\frac{\partial X_{N^+}}{\partial \rho/\rho_0}$	$\frac{\partial X_{e^-}}{\partial \rho/\rho_0}$
2000	5.48703×10^{-12}	-5.48703×10^{-12}	-2.29094×10^{-21}	-2.01225×10^{-28}	-2.29094×10^{-21}
2500	1.58421×10^{-09}	-1.58421×10^{-09}	-2.28967×10^{-17}	-1.73978×10^{-22}	-2.28969×10^{-17}
3000	6.87694×10^{-08}	-6.87694×10^{-08}	-1.09608×10^{-14}	-1.59924×10^{-18}	-1.09624×10^{-14}
3500	1.01171×10^{-06}	-1.01171×10^{-06}	-9.22084×10^{-13}	-1.09018×10^{-15}	-9.23174×10^{-13}
4000	7.57504×10^{-06}	-7.57499×10^{-06}	-2.60862×10^{-11}	-1.45694×10^{-13}	-2.62319×10^{-11}
4500	3.61725×10^{-05}	-3.61718×10^{-05}	-3.55109×10^{-10}	-6.54743×10^{-12}	-3.61656×10^{-10}
5000	1.26038×10^{-04}	-1.26032×10^{-04}	-2.87511×10^{-09}	-1.36575×10^{-10}	-3.01168×10^{-09}
5500	3.48607×10^{-04}	-3.48572×10^{-04}	-1.57947×10^{-08}	-1.62073×10^{-09}	-1.74155×10^{-08}
6000	8.08001×10^{-04}	-8.07847×10^{-04}	-6.41155×10^{-08}	-1.25158×10^{-08}	-7.66313×10^{-08}
6500	1.62576×10^{-03}	-1.62521×10^{-03}	-2.03615×10^{-07}	-6.89905×10^{-08}	-2.72606×10^{-07}
7000	2.90603×10^{-03}	-2.90440×10^{-03}	-5.26166×10^{-07}	-2.90023×10^{-07}	-8.16190×10^{-07}
7500	4.68568×10^{-03}	-4.68145×10^{-03}	-1.13690×10^{-06}	-9.76552×10^{-07}	-2.11345×10^{-06}
8000	6.88748×10^{-03}	-6.87783×10^{-03}	-2.09186×10^{-06}	-2.73480×10^{-06}	-4.82667×10^{-06}

$\log \rho/\rho_0 = 1.0$

Table XII (Cont.) Density derivatives of mole fractions (temperature constant)

$\log \rho/\rho_0 = -5.0$

T°K	$\frac{S}{R}$	S $\frac{cal}{gm\ °K}$	$\frac{H}{RT}$	H $\frac{cal}{gm}$	Z
2000	3.52611X10^{+01}	2.50017X10^{+00}	3.89271X10^{+00}	5.52060X10^{+02}	1.00000X10^{+00}
2500	3.60099X10^{+01}	2.55326X10^{+00}	3.98563X10^{+00}	7.06548X10^{+02}	1.00000X10^{+00}
3000	3.66352X10^{+01}	2.59760X10^{+00}	4.05989X10^{+00}	8.63654X10^{+02}	1.00006X10^{+00}
3500	3.71994X10^{+01}	2.63760X10^{+00}	4.14745X10^{+00}	1.02932X10^{+03}	1.00101X10^{+00}
4000	3.78572X10^{+01}	2.68425X10^{+00}	4.37980X10^{+00}	1.24227X10^{+03}	1.00754X10^{+00}
4500	3.90035X10^{+01}	2.76552X10^{+00}	5.12284X10^{+00}	1.63466X10^{+03}	1.03556X10^{+00}
5000	4.13333X10^{+01}	2.93071X10^{+00}	7.02309X10^{+00}	2.49001X10^{+03}	1.11877X10^{+00}
5500	4.54592X10^{+01}	3.22326X10^{+00}	1.06143X10^{+01}	4.13961X10^{+03}	1.29574X10^{+00}
6000	5.08525X10^{+01}	3.60567X10^{+00}	1.52652X10^{+01}	6.49469X10^{+03}	1.55385X10^{+00}
6500	5.54615X10^{+01}	3.93247X10^{+00}	1.88640X10^{+01}	8.69465X10^{+03}	1.78931X10^{+00}
7000	5.80444X10^{+01}	4.11560X10^{+00}	2.02550X10^{+01}	1.00539X10^{+04}	1.92146X10^{+00}
7500	5.93143X10^{+01}	4.20565X10^{+00}	2.03125X10^{+01}	1.08026X10^{+04}	1.97839X10^{+00}
8000	6.01469X10^{+01}	4.26468X10^{+00}	2.00011X10^{+01}	1.13461X10^{+04}	2.00745X10^{+00}

$\log \rho/\rho_0 = -2.0$

T°K	$\frac{S}{R}$	S $\frac{cal}{gm\ °K}$	$\frac{H}{RT}$	H $\frac{cal}{gm}$	Z
2000	3.29585X10^{+01}	2.33690X10^{+00}	3.89271X10^{+00}	5.52060X10^{+02}	1.00000X10^{+00}
2500	3.37073X10^{+01}	2.39000X10^{+00}	3.98558X10^{+00}	7.06539X10^{+02}	1.00000X10^{+00}
3000	3.43307X10^{+01}	2.43420X10^{+00}	4.05807X10^{+00}	8.63268X10^{+02}	1.00002X10^{+00}
3500	3.48731X10^{+01}	2.47266X10^{+00}	4.12447X10^{+00}	1.02362X10^{+03}	1.00031X10^{+00}
4000	3.53991X10^{+01}	2.50995X10^{+00}	4.22943X10^{+00}	1.19962X10^{+03}	1.00239X10^{+00}
4500	3.60469X10^{+01}	2.55589X10^{+00}	4.49374X10^{+00}	1.43392X10^{+03}	1.01138X10^{+00}
5000	3.70723X10^{+01}	2.62859X10^{+00}	5.15178X10^{+00}	1.82655X10^{+03}	1.03921X10^{+00}
5500	3.88237X10^{+01}	2.75277X10^{+00}	6.52213X10^{+00}	2.54364X10^{+03}	1.10538X10^{+00}
6000	4.15767X10^{+01}	2.94797X10^{+00}	8.83990X10^{+00}	3.76099X10^{+03}	1.22991X10^{+00}
6500	4.52182X10^{+01}	3.20617X10^{+00}	1.19429X10^{+01}	5.50465X10^{+03}	1.41436X10^{+00}
7000	4.90274X10^{+01}	3.47626X10^{+00}	1.50684X10^{+01}	7.47945X10^{+03}	1.62232X10^{+00}
7500	5.20699X10^{+01}	3.69199X10^{+00}	1.72783X10^{+01}	9.18897X10^{+03}	1.79505X10^{+00}
8000	5.40146X10^{+01}	3.82988X10^{+00}	1.82971X10^{+01}	1.03795X10^{+04}	1.90371X10^{+00}

Table XIII Entropy, enthalpy, compressibility factor

log $P/P_0 = -1$

T°K	$\frac{S}{R}$	S $\frac{cal}{gm\ °K}$	$\frac{H}{RT}$	H $\frac{cal}{gm}$	Z
2000	$3.06559 \times 10^{+01}$	$2.17364 \times 10^{+00}$	$3.89271 \times 10^{+00}$	$5.52060 \times 10^{+02}$	$1.00000 \times 10^{+00}$
2500	$3.14047 \times 10^{+01}$	$2.22673 \times 10^{+00}$	$3.98557 \times 10^{+00}$	$7.06536 \times 10^{+02}$	$1.00000 \times 10^{+00}$
3000	$3.20276 \times 10^{+01}$	$2.27090 \times 10^{+00}$	$4.05750 \times 10^{+00}$	$8.63145 \times 10^{+02}$	$1.00000 \times 10^{+00}$
3500	$3.25631 \times 10^{+01}$	$2.30886 \times 10^{+00}$	$4.11720 \times 10^{+00}$	$1.02182 \times 10^{+03}$	$1.00010 \times 10^{+00}$
4000	$3.30471 \times 10^{+01}$	$2.34319 \times 10^{+00}$	$4.18172 \times 10^{+00}$	$1.18609 \times 10^{+03}$	$1.00075 \times 10^{+00}$
4500	$3.35342 \times 10^{+01}$	$2.37772 \times 10^{+00}$	$4.29153 \times 10^{+00}$	$1.36939 \times 10^{+03}$	$1.00361 \times 10^{+00}$
5000	$3.41154 \times 10^{+01}$	$2.41894 \times 10^{+00}$	$4.52507 \times 10^{+00}$	$1.60435 \times 10^{+03}$	$1.01257 \times 10^{+00}$
5500	$3.49231 \times 10^{+01}$	$2.47620 \times 10^{+00}$	$5.00087 \times 10^{+00}$	$1.95035 \times 10^{+03}$	$1.03461 \times 10^{+00}$
6000	$3.61112 \times 10^{+01}$	$2.56045 \times 10^{+00}$	$5.85661 \times 10^{+00}$	$2.49173 \times 10^{+03}$	$1.07947 \times 10^{+00}$
6500	$3.78053 \times 10^{+01}$	$2.68057 \times 10^{+00}$	$7.19858 \times 10^{+00}$	$3.31790 \times 10^{+03}$	$1.15708 \times 10^{+00}$
7000	$4.00261 \times 10^{+01}$	$2.83803 \times 10^{+00}$	$9.02586 \times 10^{+00}$	$4.48013 \times 10^{+03}$	$1.27248 \times 10^{+00}$
7500	$4.26179 \times 10^{+01}$	$3.02180 \times 10^{+00}$	$1.11615 \times 10^{+01}$	$5.93593 \times 10^{+03}$	$1.41949 \times 10^{+00}$
8000	$4.52508 \times 10^{+01}$	$3.20848 \times 10^{+00}$	$1.32598 \times 10^{+01}$	$7.52198 \times 10^{+03}$	$1.57817 \times 10^{+00}$

log $P/P_0 = 0$

T°K	$\frac{S}{R}$	S $\frac{cal}{gm\ °K}$	$\frac{H}{RT}$	H $\frac{cal}{gm}$	Z
2000	$2.83533 \times 10^{+01}$	$2.01038 \times 10^{+00}$	$3.89271 \times 10^{+00}$	$5.52060 \times 10^{+02}$	$1.00000 \times 10^{+00}$
2500	$2.91021 \times 10^{+01}$	$2.06347 \times 10^{+00}$	$3.98556 \times 10^{+00}$	$7.06535 \times 10^{+02}$	$1.00000 \times 10^{+00}$
3000	$2.97248 \times 10^{+01}$	$2.10762 \times 10^{+00}$	$4.05731 \times 10^{+00}$	$8.63106 \times 10^{+02}$	$1.00000 \times 10^{+00}$
3500	$3.02581 \times 10^{+01}$	$2.14543 \times 10^{+00}$	$4.11490 \times 10^{+00}$	$1.02125 \times 10^{+03}$	$1.00003 \times 10^{+00}$
4000	$3.07289 \times 10^{+01}$	$2.17882 \times 10^{+00}$	$4.16662 \times 10^{+00}$	$1.18181 \times 10^{+03}$	$1.00023 \times 10^{+00}$
4500	$3.11649 \times 10^{+01}$	$2.20973 \times 10^{+00}$	$4.22725 \times 10^{+00}$	$1.34888 \times 10^{+03}$	$1.00114 \times 10^{+00}$
5000	$3.16023 \times 10^{+01}$	$2.24075 \times 10^{+00}$	$4.32328 \times 10^{+00}$	$1.53280 \times 10^{+03}$	$1.00399 \times 10^{+00}$
5500	$3.20903 \times 10^{+01}$	$2.27534 \times 10^{+00}$	$4.49492 \times 10^{+00}$	$1.75302 \times 10^{+03}$	$1.01107 \times 10^{+00}$
6000	$3.26884 \times 10^{+01}$	$2.31775 \times 10^{+00}$	$4.79339 \times 10^{+00}$	$2.03938 \times 10^{+03}$	$1.02585 \times 10^{+00}$
6500	$3.34597 \times 10^{+01}$	$2.37244 \times 10^{+00}$	$5.27312 \times 10^{+00}$	$2.43044 \times 10^{+03}$	$1.05265 \times 10^{+00}$
7000	$3.44586 \times 10^{+01}$	$2.44327 \times 10^{+00}$	$5.97942 \times 10^{+00}$	$2.96798 \times 10^{+03}$	$1.09599 \times 10^{+00}$
7500	$3.57153 \times 10^{+01}$	$2.53237 \times 10^{+00}$	$6.93294 \times 10^{+00}$	$3.68708 \times 10^{+03}$	$1.15940 \times 10^{+00}$
8000	$3.72194 \times 10^{+01}$	$2.63902 \times 10^{+00}$	$8.11430 \times 10^{+00}$	$4.60304 \times 10^{+03}$	$1.24393 \times 10^{+00}$

Table XIII (Cont.) Entropy, enthalpy, compressibility factor

$T\,^\circ K$	$\frac{S}{R}$	$S\ \frac{cal}{gm\,^\circ K}$	$\frac{H}{RT}$	$H\ \frac{cal}{gm}$	Z
2000	$2.60507\times10^{+01}$	$1.84711\times10^{+00}$	$3.89271\times10^{+00}$	$5.52060\times10^{+02}$	$1.00000\times10^{+00}$
2500	$2.67995\times10^{+01}$	$1.90020\times10^{+00}$	$3.98556\times10^{+00}$	$7.06535\times10^{+02}$	$1.00000\times10^{+00}$
3000	$2.74221\times10^{+01}$	$1.94435\times10^{+00}$	$4.05726\times10^{+00}$	$8.63094\times10^{+02}$	$1.00000\times10^{+00}$
3500	$2.79548\times10^{+01}$	$1.98212\times10^{+00}$	$4.11418\times10^{+00}$	$1.02107\times10^{+03}$	$1.00001\times10^{+00}$
4000	$2.84214\times10^{+01}$	$2.01520\times10^{+00}$	$4.16184\times10^{+00}$	$1.18045\times10^{+03}$	$1.00007\times10^{+00}$
4500	$2.88411\times10^{+01}$	$2.04496\times10^{+00}$	$4.20689\times10^{+00}$	$1.34238\times10^{+03}$	$1.00036\times10^{+00}$
5000	$2.92328\times10^{+01}$	$2.07274\times10^{+00}$	$4.25910\times10^{+00}$	$1.51005\times10^{+03}$	$1.00126\times10^{+00}$
5500	$2.96175\times10^{+01}$	$2.10001\times10^{+00}$	$4.33237\times10^{+00}$	$1.68963\times10^{+03}$	$1.00351\times10^{+00}$
6000	$3.00187\times10^{+01}$	$2.12846\times10^{+00}$	$4.44436\times10^{+00}$	$1.89088\times10^{+03}$	$1.00824\times10^{+00}$
6500	$3.04618\times10^{+01}$	$2.15988\times10^{+00}$	$4.61514\times10^{+00}$	$2.12717\times10^{+03}$	$1.01695\times10^{+00}$

log ρ/ρ_0 = 10

Table XIII (Cont.) Entropy, enthalpy, compressibility factor

$\log \rho/\rho_0 = -3.0$

$T\,°K$	P/P_0	$\partial(P/P_0)/\partial(\rho/\rho_0)$	M_{gm}	$\partial M/\partial T$ $gms/°K$	$\partial M/\partial(\rho/\rho_0)$
2000	6.94058X10^{-03}	6.94058X10^{+00}	2.80140X10^{+01}	-2.17866X10^{-09}	7.68568X10^{-05}
2500	8.67573X10^{-03}	8.67573X10^{+00}	2.80139X10^{+01}	-4.01947X10^{-07}	2.21900X10^{-02}
3000	1.04115X10^{-02}	1.04112X10^{+01}	2.80120X10^{+01}	-1.20933X10^{-05}	9.63057X10^{-01}
3500	1.21582X10^{-02}	1.21521X10^{+01}	2.79856X10^{+01}	-1.30130X10^{-04}	1.41286X10^{+01}
4000	1.39859X10^{-02}	1.39337X10^{+01}	2.78041X10^{+01}	-7.30664X10^{-04}	1.03754X10^{+02}
4500	1.61716X10^{-02}	1.58990X10^{+01}	2.70519X10^{+01}	-2.53599X10^{-03}	4.56097X10^{+02}
5000	1.94123X10^{-02}	1.84469X10^{+01}	2.50398X10^{+01}	-5.60939X10^{-03}	1.24535X10^{+03}
5500	2.47313X10^{-02}	2.23979X10^{+01}	2.16200X10^{+01}	-7.60209X10^{-03}	2.03984X10^{+03}
6000	3.23540X10^{-02}	2.87893X10^{+01}	1.80286X10^{+01}	-6.23431X10^{-03}	1.98634X10^{+03}
6500	4.03614X10^{-02}	3.72219X10^{+01}	1.56562X10^{+01}	-3.26554X10^{-03}	1.21780X10^{+03}
7000	4.66761X10^{-02}	4.48853X10^{+01}	1.45795X10^{+01}	-1.28991X10^{-03}	5.59375X10^{+02}
7500	5.14920X10^{-02}	5.04944X10^{+01}	1.41599X10^{+01}	-5.32276X10^{-04}	2.74309X10^{+02}
8000	5.57316X10^{-02}	5.48520X10^{+01}	1.39549X10^{+01}	-3.43197X10^{-04}	2.20264X10^{+02}

$\log \rho/\rho_0 = -2.0$

$T\,°K$	P/P_0	$\partial(P/P_0)/\partial(\rho/\rho_0)$	M_{gm}	$\partial M/\partial T$ $gms/°K$	$\partial M/\partial(\rho/\rho_0)$
2000	6.94058X10^{-02}	6.94058X10^{+00}	2.80140X10^{+01}	-6.88954X10^{-10}	2.43042X10^{-06}
2500	8.67572X10^{-02}	8.67572X10^{+00}	2.80139X10^{+01}	-1.27107X10^{-07}	7.01712X10^{-04}
3000	1.04110X10^{-01}	1.04109X10^{+01}	2.80133X10^{+01}	-3.82480X10^{-06}	3.04588X10^{-02}
3500	1.21499X10^{-01}	1.21479X10^{+01}	2.80050X10^{+01}	-4.12361X10^{-05}	4.47714X10^{-01}
4000	1.39143X10^{-01}	1.38977X10^{+01}	2.79471X10^{+01}	-2.34652X10^{-04}	3.33205X10^{+00}
4500	1.57941X10^{-01}	1.57057X10^{+01}	2.76986X10^{+01}	-8.61935X10^{-04}	1.55019X10^{+01}
5000	1.80319X10^{-01}	1.76984X10^{+01}	2.69568X10^{+01}	-2.24523X10^{-03}	4.98477X10^{+01}
5500	2.10980X10^{-01}	2.01481X10^{+01}	2.53431X10^{+01}	-4.25209X10^{-03}	1.14101X10^{+02}
6000	2.56090X10^{-01}	2.35254X10^{+01}	2.27771X10^{+01}	-5.81576X10^{-03}	1.85315X10^{+02}
6500	3.19035X10^{-01}	2.84463X10^{+01}	1.98068X10^{+01}	-5.75863X10^{-03}	2.14637X10^{+02}
7000	3.94095X10^{-01}	3.52401X10^{+01}	1.72678X10^{+01}	-4.24403X10^{-03}	1.82690X10^{+02}
7500	4.67201X10^{-01}	4.31056X10^{+01}	1.56062X10^{+01}	-2.45251X10^{-03}	1.20736X10^{+02}
8000	5.28515X10^{-01}	5.03736X10^{+01}	1.47154X10^{+01}	-1.22908X10^{-03}	6.89922X10^{+01}

Table XIV Pressure, density derivative of pressure (temperature constant), molecular weight, temperature and density derivative of molecular weight

$\log P/P_0 = -1.0$

T°K	$\frac{P}{P_0}$	$\frac{\partial P/P_0}{\partial \rho/\rho_0}$	$M_{gm.}$	$\frac{\partial M}{\partial T}$ $\frac{gms}{°K}$	$\frac{\partial M}{\partial \rho/\rho_0}$
2000	6.94058×10^{-01}	$6.94058 \times 10^{+00}$	$2.80140 \times 10^{+01}$	-2.17866×10^{-10}	7.68569×10^{-08}
2500	8.67572×10^{-01}	$8.67572 \times 10^{+00}$	$2.80139 \times 10^{+01}$	-4.01949×10^{-08}	2.21901×10^{-05}
3000	$1.04109 \times 10^{+00}$	$1.04109 \times 10^{+01}$	$2.80138 \times 10^{+01}$	-1.20956×10^{-06}	9.63235×10^{-04}
3500	$1.21472 \times 10^{+00}$	$1.21466 \times 10^{+01}$	$2.80111 \times 10^{+01}$	-1.30485×10^{-05}	1.41672×10^{-02}
4000	$1.38916 \times 10^{+00}$	$1.38864 \times 10^{+01}$	$2.79927 \times 10^{+01}$	-7.45684×10^{-05}	1.05886×10^{-01}
4500	$1.56727 \times 10^{+00}$	$1.56445 \times 10^{+01}$	$2.79131 \times 10^{+01}$	-2.78982×10^{-04}	5.01753×10^{-01}
5000	$1.75695 \times 10^{+00}$	$1.74612 \times 10^{+01}$	$2.76661 \times 10^{+01}$	-7.68707×10^{-04}	$1.70666 \times 10^{+00}$
5500	$1.97473 \times 10^{+00}$	$1.94227 \times 10^{+01}$	$2.70766 \times 10^{+01}$	-1.65831×10^{-03}	$4.45010 \times 10^{+00}$
6000	$2.24764 \times 10^{+00}$	$2.16832 \times 10^{+01}$	$2.59515 \times 10^{+01}$	-2.87412×10^{-03}	$9.15892 \times 10^{+00}$
6500	$2.61002 \times 10^{+00}$	$2.44789 \times 10^{+01}$	$2.42108 \times 10^{+01}$	-4.03442×10^{-03}	$1.50393 \times 10^{+01}$
7000	$3.09112 \times 10^{+00}$	$2.81206 \times 10^{+01}$	$2.20151 \times 10^{+01}$	-4.61673×10^{-03}	$1.98746 \times 10^{+01}$
7500	$3.69455 \times 10^{+00}$	$3.29234 \times 10^{+01}$	$1.97351 \times 10^{+01}$	-4.36978×10^{-03}	$2.14847 \times 10^{+01}$
8000	$4.38137 \times 10^{+00}$	$3.90111 \times 10^{+01}$	$1.77509 \times 10^{+01}$	-3.49760×10^{-03}	$1.94573 \times 10^{+01}$

$\log P/P_0 = 0$

T°K	$\frac{P}{P_0}$	$\frac{\partial P/P_0}{\partial \rho/\rho_0}$	$M_{gm.}$	$\frac{\partial M}{\partial T}$ $\frac{gms}{°K}$	$\frac{\partial M}{\partial \rho/\rho_0}$
2000	$6.94058 \times 10^{+00}$	$6.94058 \times 10^{+00}$	$2.80140 \times 10^{+01}$	-6.88954×10^{-11}	2.43042×10^{-09}
2500	$8.67572 \times 10^{+00}$	$8.67572 \times 10^{+00}$	$2.80140 \times 10^{+01}$	-1.27107×10^{-08}	7.01713×10^{-07}
3000	$1.04108 \times 10^{+01}$	$1.04108 \times 10^{+01}$	$2.80139 \times 10^{+01}$	-3.82502×10^{-07}	3.04606×10^{-05}
3500	$1.21464 \times 10^{+01}$	$1.21462 \times 10^{+01}$	$2.80131 \times 10^{+01}$	-4.12718×10^{-06}	4.48101×10^{-04}
4000	$1.38844 \times 10^{+01}$	$1.38828 \times 10^{+01}$	$2.80072 \times 10^{+01}$	-2.36172×10^{-05}	3.35364×10^{-03}
4500	$1.56341 \times 10^{+01}$	$1.56252 \times 10^{+01}$	$2.79819 \times 10^{+01}$	-8.88776×10^{-05}	1.59847×10^{-02}
5000	$1.74207 \times 10^{+01}$	$1.73861 \times 10^{+01}$	$2.79025 \times 10^{+01}$	-2.49407×10^{-04}	5.53730×10^{-02}
5500	$1.92980 \times 10^{+01}$	$1.91929 \times 10^{+01}$	$2.77070 \times 10^{+01}$	-5.62535×10^{-04}	1.50958×10^{-01}
6000	$2.13599 \times 10^{+01}$	$2.10943 \times 10^{+01}$	$2.73080 \times 10^{+01}$	-1.06559×10^{-03}	3.39583×10^{-01}
6500	$2.37445 \times 10^{+01}$	$2.31666 \times 10^{+01}$	$2.66128 \times 10^{+01}$	-1.73719×10^{-03}	6.47638×10^{-01}
7000	$2.66239 \times 10^{+01}$	$2.55164 \times 10^{+01}$	$2.55603 \times 10^{+01}$	-2.46961×10^{-03}	$1.06330 \times 10^{+00}$
7500	$3.01760 \times 10^{+01}$	$2.82798 \times 10^{+01}$	$2.41623 \times 10^{+01}$	-3.08746×10^{-03}	$1.51833 \times 10^{+00}$
8000	$3.45345 \times 10^{+01}$	$3.16140 \times 10^{+01}$	$2.25204 \times 10^{+01}$	-3.42318×10^{-03}	$1.90451 \times 10^{+00}$

Table XIV (Cont.) Pressure, density derivative of pressure (temperature constant), molecular weight, temperature and density derivatives of molecular weight

$T\,°K$	$\frac{P}{P_0}$	$\frac{\partial P/P_0}{\partial \rho/\rho_0}$	M gms	$\frac{\partial M}{\partial T}$ $\frac{gms}{°K}$	$\frac{\partial M}{\partial \rho/\rho_0}$
2000	$6.94058\times10^{+01}$	$6.94058\times10^{+00}$	$2.80140\times10^{+01}$	-2.17866×10^{-11}	7.68569×10^{-11}
2500	$8.67572\times10^{+01}$	$8.67572\times10^{+00}$	$2.80140\times10^{+01}$	-4.01949×10^{-09}	2.21901×10^{-08}
3000	$1.04108\times10^{+02}$	$1.04108\times10^{+01}$	$2.80139\times10^{+01}$	-1.20958×10^{-07}	9.63253×10^{-07}
3500	$1.21461\times10^{+02}$	$1.21460\times10^{+01}$	$2.80137\times10^{+01}$	-1.30521×10^{-06}	1.41711×10^{-05}
4000	$1.38822\times10^{+02}$	$1.38816\times10^{+01}$	$2.80118\times10^{+01}$	-7.47210×10^{-06}	1.06103×10^{-04}
4500	$1.56219\times10^{+02}$	$1.56191\times10^{+01}$	$2.80038\times10^{+01}$	-2.81716×10^{-05}	5.06669×10^{-04}
5000	$1.73733\times10^{+02}$	$1.73624\times10^{+01}$	$2.79786\times10^{+01}$	-7.95169×10^{-05}	1.76542×10^{-03}
5500	$1.91537\times10^{+02}$	$1.91202\times10^{+01}$	$2.79158\times10^{+01}$	-1.81959×10^{-04}	4.88296×10^{-03}
6000	$2.09934\times10^{+02}$	$2.09079\times10^{+01}$	$2.77848\times10^{+01}$	-3.55145×10^{-04}	1.13178×10^{-02}
6500	$2.29394\times10^{+02}$	$2.27497\times10^{+01}$	$2.75468\times10^{+01}$	-6.10836×10^{-04}	2.27730×10^{-02}
7000	$2.50551\times10^{+02}$	$2.46796\times10^{+01}$	$2.71607\times10^{+01}$	-9.45434×10^{-04}	4.07088×10^{-02}
7500	$2.74187\times10^{+02}$	$2.67419\times10^{+01}$	$2.65921\times10^{+01}$	-1.33472×10^{-03}	6.56460×10^{-02}
8000	$3.01164\times10^{+02}$	$2.89909\times10^{+01}$	$2.58242\times10^{+01}$	-1.73437×10^{-03}	9.65113×10^{-02}

$\log \rho/\rho_0 = 1.0$

Table XIV Pressure, density derivative of pressure (temperature constant), molecular weight, temperature and density derivatives of molecular weight

T°K	C_v $\frac{cal.}{gm\,°K}$	C_p $\frac{cal.}{gm\,°K}$	γ	a/a_0
2000	2.35174×10^{-01}	3.06083×10^{-01}	$1.30151 \times 10^{+00}$	$2.54014 \times 10^{+00}$
2500	2.40561×10^{-01}	3.11476×10^{-01}	$1.29478 \times 10^{+00}$	$2.83262 \times 10^{+00}$
3000	2.47138×10^{-01}	3.18239×10^{-01}	$1.28769 \times 10^{+00}$	$3.09452 \times 10^{+00}$
3500	2.82691×10^{-01}	3.56038×10^{-01}	$1.25946 \times 10^{+00}$	$3.30639 \times 10^{+00}$
4000	4.55833×10^{-01}	5.43414×10^{-01}	$1.19213 \times 10^{+00}$	$3.44454 \times 10^{+00}$
4500	$1.00845 \times 10^{+00}$	$1.15945 \times 10^{+00}$	$1.14973 \times 10^{+00}$	$3.61342 \times 10^{+00}$
5000	$2.19377 \times 10^{+00}$	$2.56902 \times 10^{+00}$	$1.17104 \times 10^{+00}$	$3.92812 \times 10^{+00}$
5500	$3.74183 \times 10^{+00}$	$4.61513 \times 10^{+00}$	$1.23338 \times 10^{+00}$	$4.44211 \times 10^{+00}$
6000	$4.33229 \times 10^{+00}$	$5.50299 \times 10^{+00}$	$1.27022 \times 10^{+00}$	$5.11084 \times 10^{+00}$
6500	$3.10729 \times 10^{+00}$	$3.87081 \times 10^{+00}$	$1.24571 \times 10^{+00}$	$5.75500 \times 10^{+00}$
7000	$1.62615 \times 10^{+00}$	$1.99768 \times 10^{+00}$	$1.22847 \times 10^{+00}$	$6.27582 \times 10^{+00}$
7500	9.64916×10^{-01}	$1.20000 \times 10^{+00}$	$1.24364 \times 10^{+00}$	$6.69738 \times 10^{+00}$
8000	8.50260×10^{-01}	$1.05740 \times 10^{+00}$	$1.24361 \times 10^{+00}$	$6.98033 \times 10^{+00}$

$\log P/P_0 = -3.0$

T°K	C_v $\frac{cal}{gm\,°K}$	C_p $\frac{cal}{gm\,°K}$	γ	a/a_0
2000	2.35173×10^{-01}	3.06083×10^{-01}	$1.30152 \times 10^{+00}$	$2.54014 \times 10^{+00}$
2500	2.40483×10^{-01}	3.11394×10^{-01}	$1.29486 \times 10^{+00}$	$2.83270 \times 10^{+00}$
3000	2.44798×10^{-01}	3.15768×10^{-01}	$1.28991 \times 10^{+00}$	$3.09714 \times 10^{+00}$
3500	2.57563×10^{-01}	3.29240×10^{-01}	$1.27828 \times 10^{+00}$	$3.33044 \times 10^{+00}$
4000	3.13792×10^{-01}	3.89816×10^{-01}	$1.24227 \times 10^{+00}$	$3.51170 \times 10^{+00}$
4500	4.95710×10^{-01}	5.89443×10^{-01}	$1.18908 \times 10^{+00}$	$3.65234 \times 10^{+00}$
5000	9.26225×10^{-01}	$1.07685 \times 10^{+00}$	$1.16263 \times 10^{+00}$	$3.83375 \times 10^{+00}$
5500	$1.69195 \times 10^{+00}$	$1.99540 \times 10^{+00}$	$1.17935 \times 10^{+00}$	$4.11978 \times 10^{+00}$
6000	$2.67496 \times 10^{+00}$	$3.28361 \times 10^{+00}$	$1.22753 \times 10^{+00}$	$4.54173 \times 10^{+00}$
6500	$3.40909 \times 10^{+00}$	$4.34842 \times 10^{+00}$	$1.27553 \times 10^{+00}$	$5.09091 \times 10^{+00}$
7000	$3.32207 \times 10^{+00}$	$4.27417 \times 10^{+00}$	$1.28660 \times 10^{+00}$	$5.69083 \times 10^{+00}$
7500	$2.47097 \times 10^{+00}$	$3.12578 \times 10^{+00}$	$1.26500 \times 10^{+00}$	$6.24091 \times 10^{+00}$
8000	$1.58346 \times 10^{+00}$	$1.97760 \times 10^{+00}$	$1.24891 \times 10^{+00}$	$6.70352 \times 10^{+00}$

$\log P/P_0 = -2.0$

Table XV Specific heats, specific heat ratio, speed of sound

T °K	C_v $\frac{cal}{gm\,°K}$	C_p $\frac{cal}{gm\,°K}$	γ	a/a_o
2000	2.35173×10^{-01}	3.06083×10^{-01}	$1.30152\times10^{+00}$	$2.54014\times10^{+00}$
2500	2.40458×10^{-01}	3.11368×10^{-01}	$1.29489\times10^{+00}$	$2.83273\times10^{+00}$
3000	2.44058×10^{-01}	3.14986×10^{-01}	$1.29062\times10^{+00}$	$3.09798\times10^{+00}$
3500	2.49609×10^{-01}	3.20761×10^{-01}	$1.28505\times10^{+00}$	$3.33906\times10^{+00}$
4000	2.68532×10^{-01}	3.41043×10^{-01}	$1.27002\times10^{+00}$	$3.54925\times10^{+00}$
4500	3.27565×10^{-01}	4.05416×10^{-01}	$1.23766\times10^{+00}$	$3.71894\times10^{+00}$
5000	4.70316×10^{-01}	5.64031×10^{-01}	$1.19925\times10^{+00}$	$3.86749\times10^{+00}$
5500	7.46458×10^{-01}	8.79763×10^{-01}	$1.17858\times10^{+00}$	$4.04363\times10^{+00}$
6000	$1.18503\times10^{+00}$	$1.40486\times10^{+00}$	$1.18550\times10^{+00}$	$4.28498\times10^{+00}$
6500	$1.75463\times10^{+00}$	$2.13426\times10^{+00}$	$1.21635\times10^{+00}$	$4.61172\times10^{+00}$
7000	$2.32942\times10^{+00}$	$2.93354\times10^{+00}$	$1.25934\times10^{+00}$	$5.02945\times10^{+00}$
7500	$2.70356\times10^{+00}$	$3.50317\times10^{+00}$	$1.29575\times10^{+00}$	$5.52014\times10^{+00}$
8000	$2.69804\times10^{+00}$	$3.53224\times10^{+00}$	$1.30919\times10^{+00}$	$6.03992\times10^{+00}$

$\log \rho/\rho_o = -1.0$

T °K	C_v $\frac{cal}{gm\,°K}$	C_p $\frac{cal}{gm\,°K}$	γ	a/a_o
2000	2.35173×10^{-01}	3.06082×10^{-01}	$1.30152\times10^{+00}$	$2.54014\times10^{+00}$
2500	2.40451×10^{-01}	3.11360×10^{-01}	$1.29490\times10^{+00}$	$2.83274\times10^{+00}$
3000	2.43823×10^{-01}	3.14739×10^{-01}	$1.29084\times10^{+00}$	$3.09825\times10^{+00}$
3500	2.47093×10^{-01}	3.18079×10^{-01}	$1.28728\times10^{+00}$	$3.34190\times10^{+00}$
4000	2.54185×10^{-01}	3.25600×10^{-01}	$1.28095\times10^{+00}$	$3.56403\times10^{+00}$
4500	2.73780×10^{-01}	3.46857×10^{-01}	$1.26691\times10^{+00}$	$3.76030\times10^{+00}$
5000	3.20251×10^{-01}	3.98104×10^{-01}	$1.24309\times10^{+00}$	$3.92907\times10^{+00}$
5500	4.11803×10^{-01}	5.00889×10^{-01}	$1.21633\times10^{+00}$	$4.08349\times10^{+00}$
6000	5.65941×10^{-01}	6.78128×10^{-01}	$1.19823\times10^{+00}$	$4.24902\times10^{+00}$
6500	7.92870×10^{-01}	9.48069×10^{-01}	$1.19574\times10^{+00}$	$4.44822\times10^{+00}$
7000	$1.08785\times10^{+00}$	$1.31573\times10^{+00}$	$1.20946\times10^{+00}$	$4.69507\times10^{+00}$
7500	$1.42477\times10^{+00}$	$1.76121\times10^{+00}$	$1.23613\times10^{+00}$	$4.99698\times10^{+00}$
8000	$1.75445\times10^{+00}$	$2.22763\times10^{+00}$	$1.26970\times10^{+00}$	$5.35460\times10^{+00}$

$\log \rho/\rho_o = 0$

Table XV (Cont.) Specific heats, specific heat ratio, speed of sound

T°K	$C_v \frac{cal}{gm\,°K}$	$C_p \frac{cal}{gm\,°K}$	γ	a/a_0
2000	2.35173×10^{-01}	3.06082×10^{-01}	$1.30152 \times 10^{+00}$	$2.54014 \times 10^{+00}$
2500	2.40448×10^{-01}	3.11358×10^{-01}	$1.29490 \times 10^{+00}$	$2.83274 \times 10^{+00}$
3000	2.43749×10^{-01}	3.14661×10^{-01}	$1.29091 \times 10^{+00}$	$3.09833 \times 10^{+00}$
3500	2.46297×10^{-01}	3.17231×10^{-01}	$1.28800 \times 10^{+00}$	$3.34281 \times 10^{+00}$
4000	2.49645×10^{-01}	3.20714×10^{-01}	$1.28467 \times 10^{+00}$	$3.56906 \times 10^{+00}$
4500	2.56711×10^{-01}	3.28302×10^{-01}	$1.27888 \times 10^{+00}$	$3.77728 \times 10^{+00}$
5000	2.72193×10^{-01}	3.45271×10^{-01}	$1.26847 \times 10^{+00}$	$3.96626 \times 10^{+00}$
5500	3.02191×10^{-01}	3.78677×10^{-01}	$1.25310 \times 10^{+00}$	$4.13691 \times 10^{+00}$
6000	3.53225×10^{-01}	4.36445×10^{-01}	$1.23560 \times 10^{+00}$	$4.29566 \times 10^{+00}$
6500	4.30999×10^{-01}	5.26184×10^{-01}	$1.22084 \times 10^{+00}$	$4.45404 \times 10^{+00}$
7000	5.39094×10^{-01}	6.53936×10^{-01}	$1.21302 \times 10^{+00}$	$4.62424 \times 10^{+00}$
7500	6.77698×10^{-01}	8.22808×10^{-01}	$1.21412 \times 10^{+00}$	$4.81574 \times 10^{+00}$
8000	8.42574×10^{-01}	$1.03141 \times 10^{+00}$	$1.22412 \times 10^{+00}$	$5.03478 \times 10^{+00}$

$\log \rho/\rho_0 = 1.0$

Table XV (Cont.) Specific heats, specific heat ratio, speed of sound